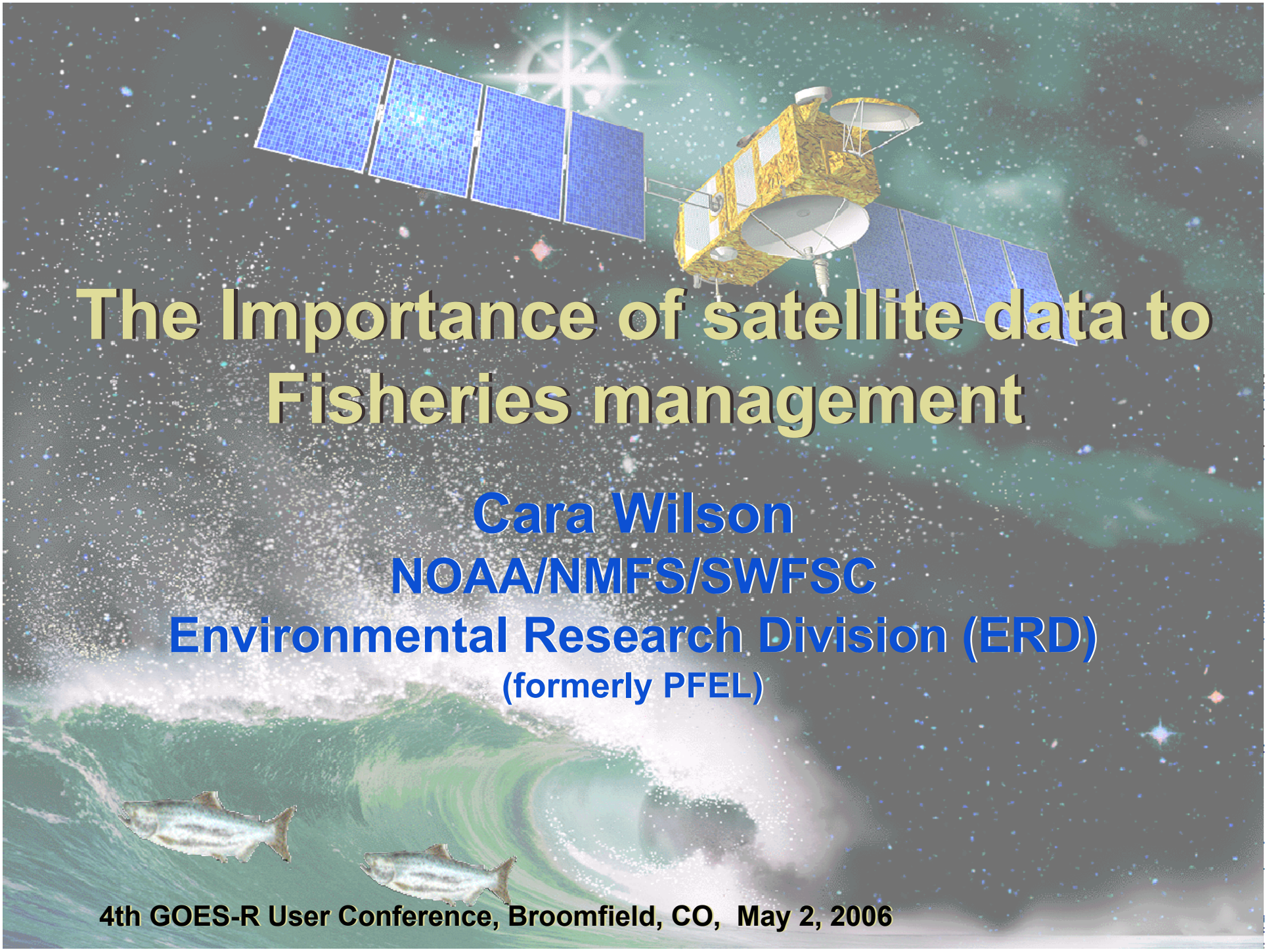

The Importance of satellite data to Fisheries management

Cara Wilson

NOAA/NMFS/SWFSC

Environmental Research Division (ERD)

(formerly PFEL)

4th GOES-R User Conference, Broomfield, CO, May 2, 2006

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Acknowledgments

Special thanks to

Stan Wilson and John Pereira (NESDIS)

and

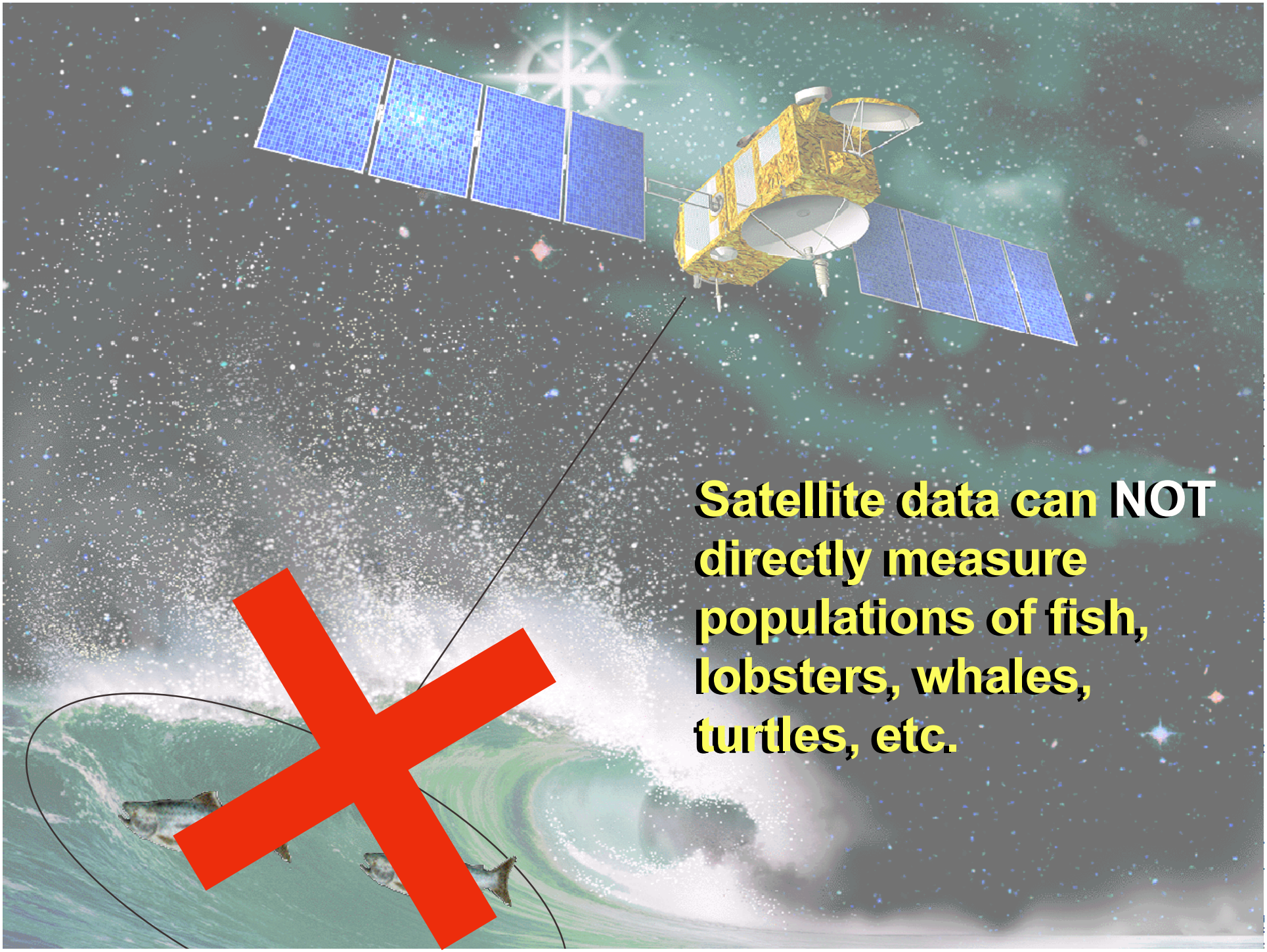
NOAA's Satellite Research & Operations (R&O) transition project

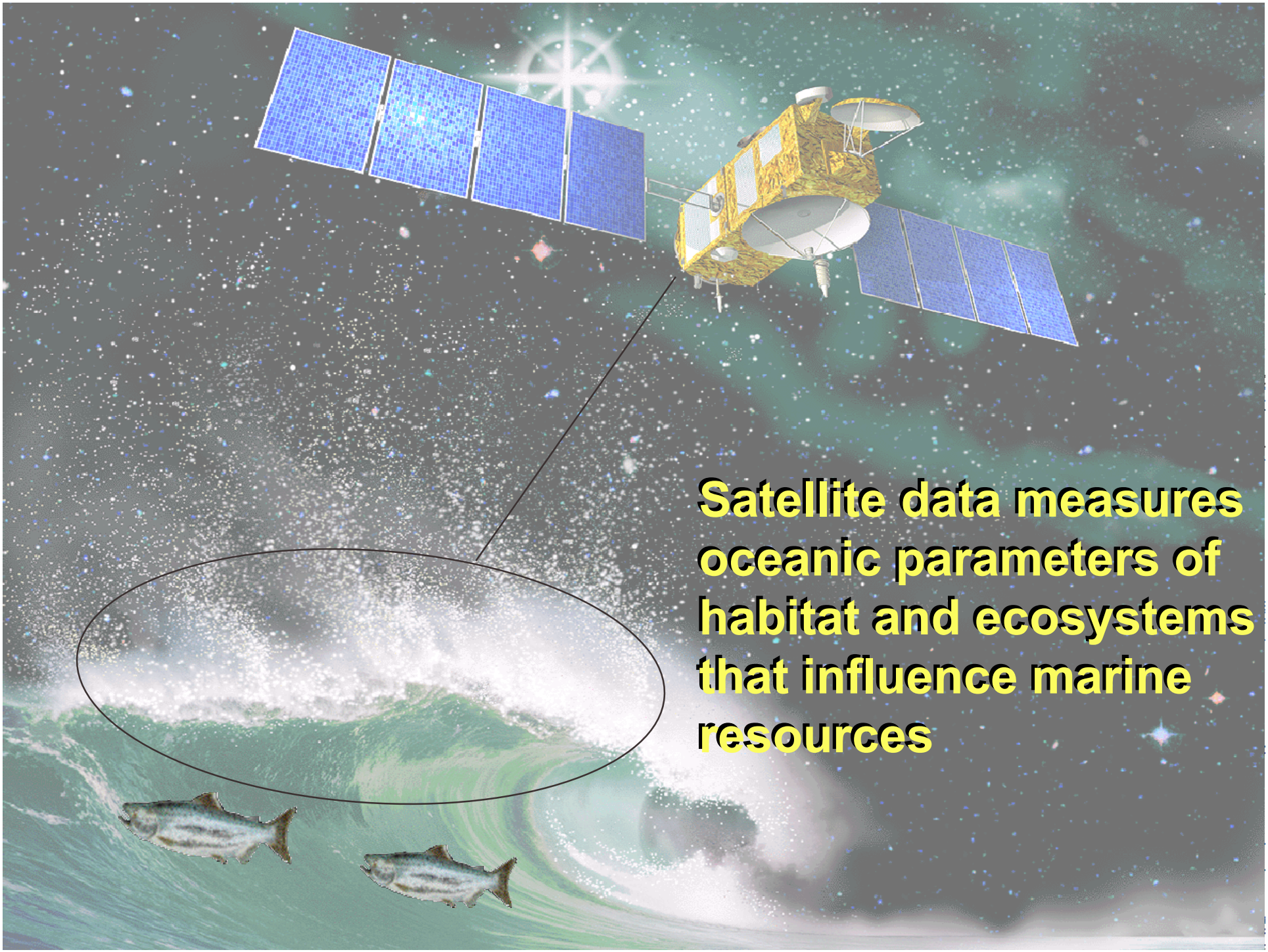
Outline

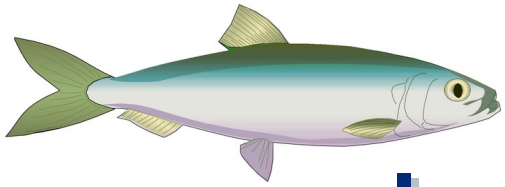
- Overview of satellite data & fisheries
- Impacts of the HES-CW to NOAA Fisheries
- User requirements

Ultimate Ecosystem

from presentation by Jack Dunnigan, former Ecosystem Goal Team Lead


Satellite data can NOT directly measure populations of fish, lobsters, whales, turtles, etc.

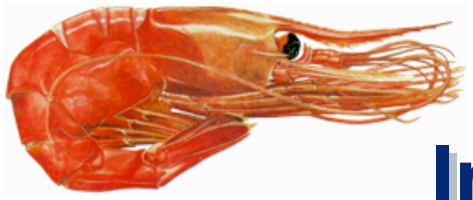

Satellite data measures oceanic parameters of habitat and ecosystems that influence marine resources



Ocean Features Important to Ecosystems

- Ocean ‘fronts’, boundaries, ‘edges’
- River plumes
- Coastal regions
- Mesoscale circulation patterns: eddies, meanders, ‘loops’
- Convergence zones
- Subsurface thermal structure: MLD, thermocline
- Ocean surface winds
- Ocean currents
- Wave heights

Most of these ocean features can not be adequately resolved without satellite data

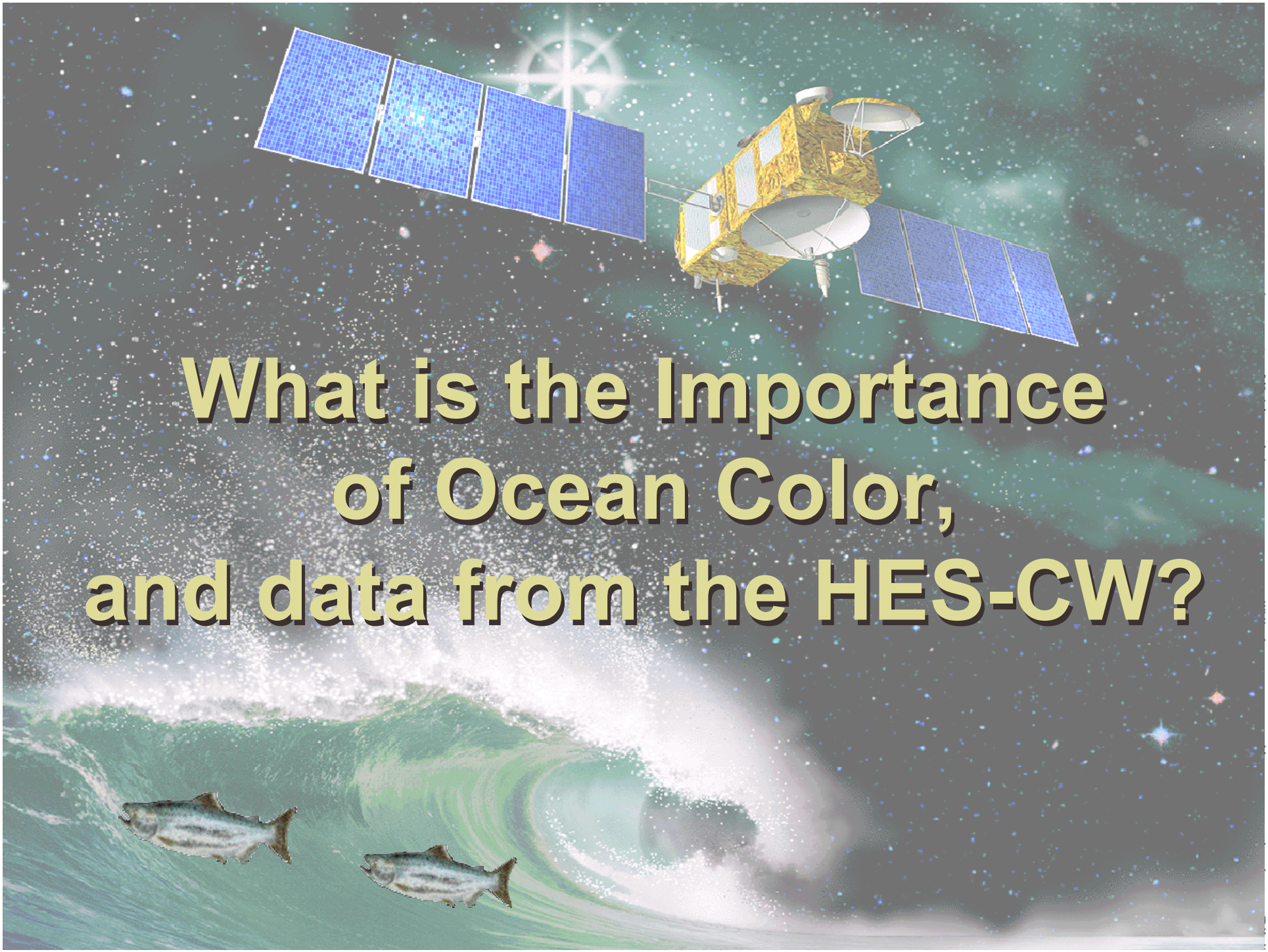


Temporal Events Important to Ecosystems

- Upwelling
- Harmful Algae Blooms (HABs)
- Oil Spills
- Seasonal Transitions
- El Niño events
- Regime Shifts (i.e. PDO)
- Global Climate Change

Climate change can affect the timing and/or intensity of many of these processes

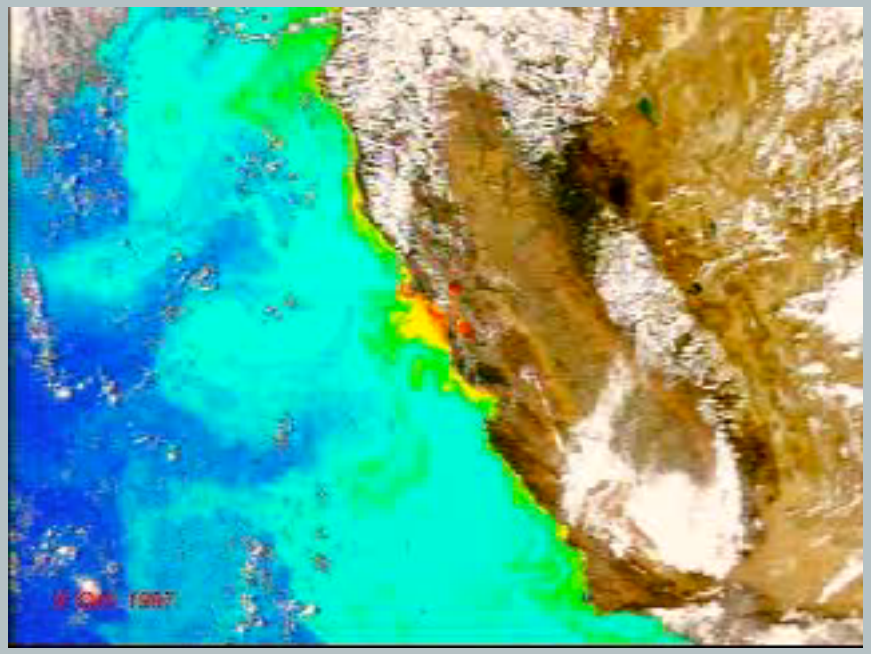
Climate Data Records (CDRs) of satellite measurements need to be maintained!


What is the Importance
of Ocean Color,
and data from the HES-CW?

Ocean Color Data

Satellite ocean color provides measurements of chlorophyll and primary productivity, which quantify the base of the marine food chain.

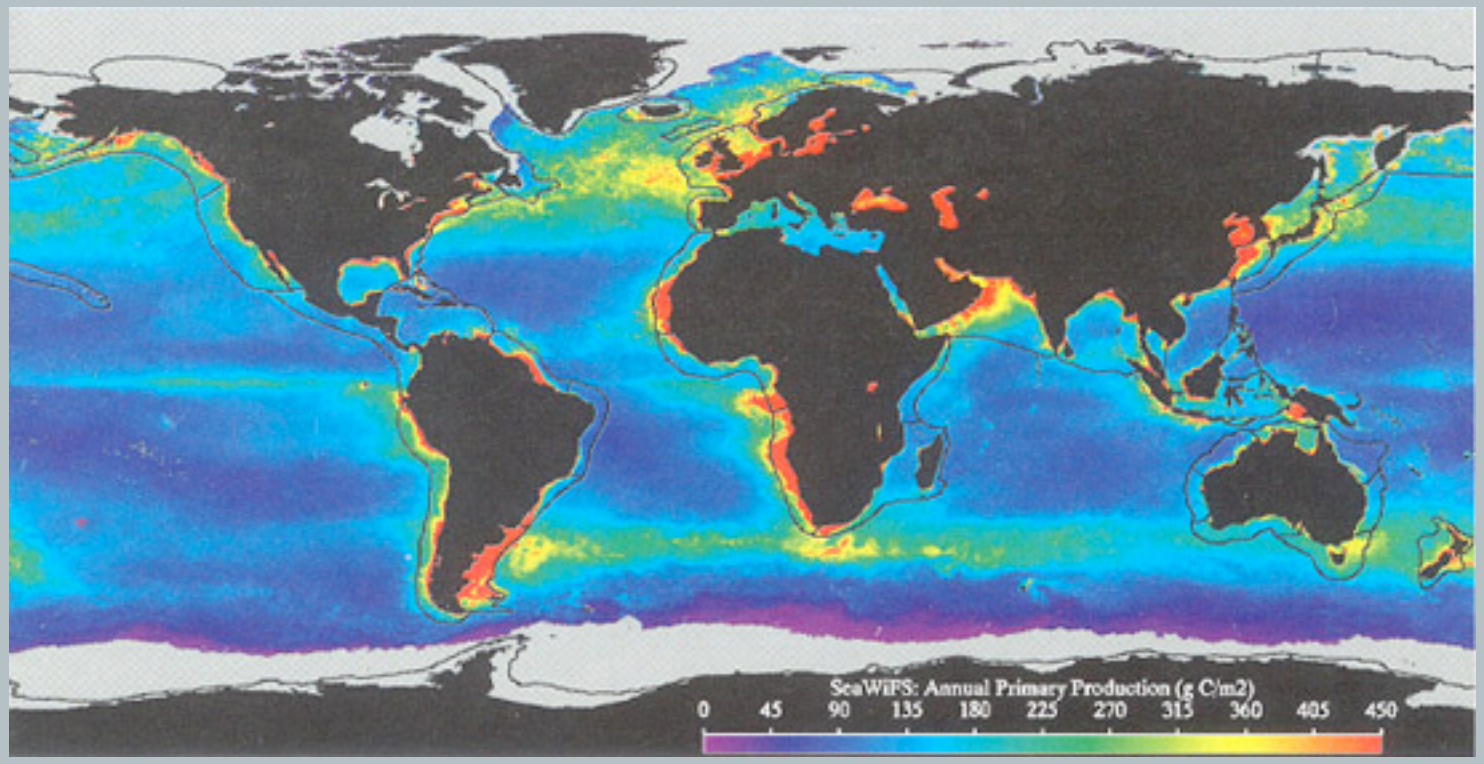
No other biological component of the marine ecosystem is accessible to satellite remote sensing.



Animation is not a continuous time sequence, but rather is a selection of ***relatively cloud-free*** scenes.

Animation by NASA Goddard Scientific Visualization Studio
http://svs.gsfc.nasa.gov

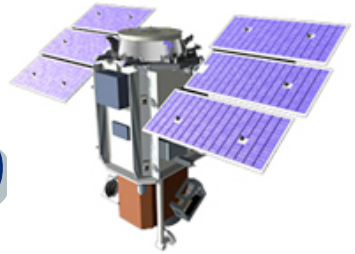
Large Marine Ecosystems

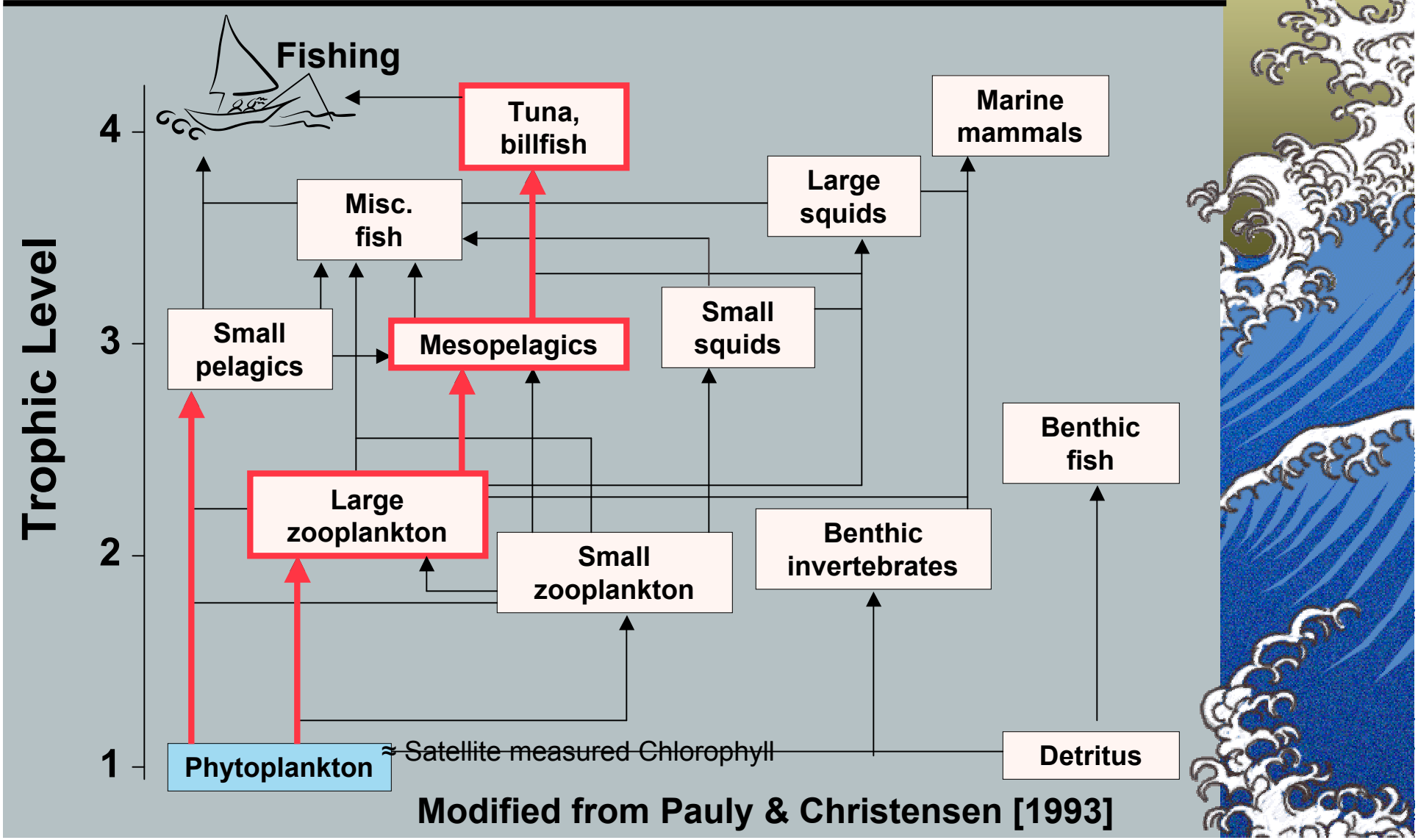


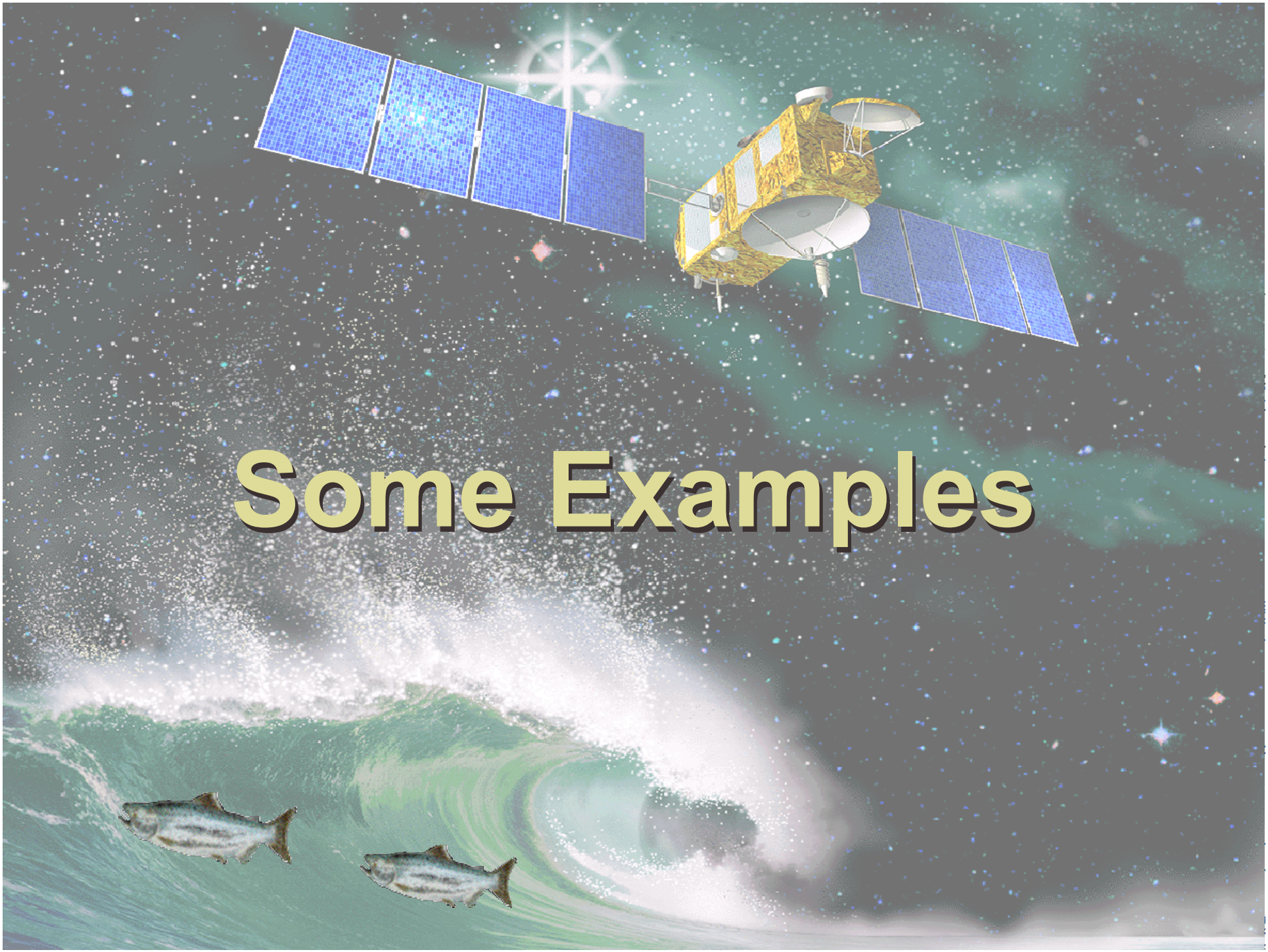
Annual satellite-derived Primary Productivity and the outlines of the 64 defined LMEs

Sherman et al., MEPS, 2005 *NOAA/NMFS/NEFSC*

Oceanic Food Web





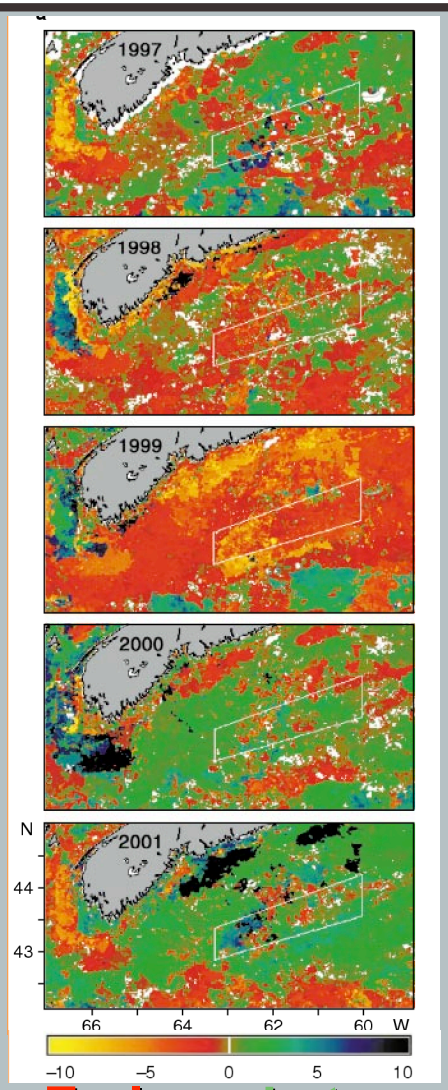

Some Examples

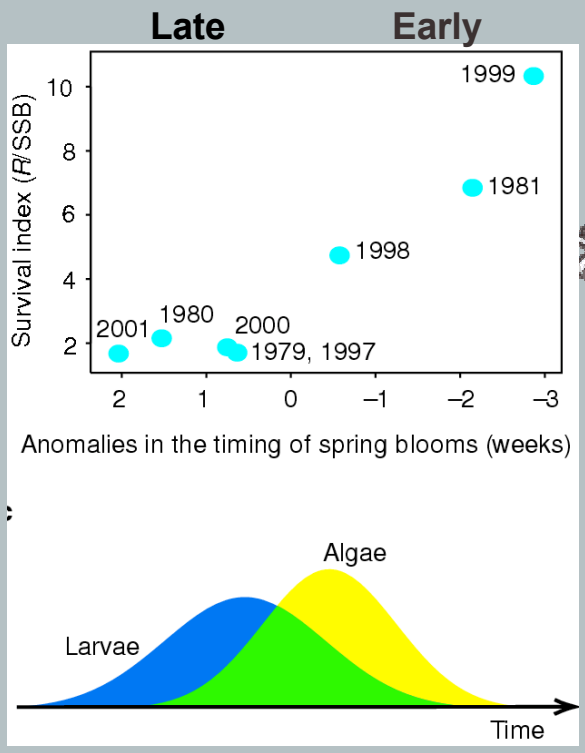
Timing of the Spring bloom and Haddock Survival

(Melanogrammus aeglefinus)

Test of the match-mismatch hypothesis

Annual anomaly in the timing of the spring bloom based on SeaWiFS chlorophyll data





Earlier bloom means more time in the 'green' zone

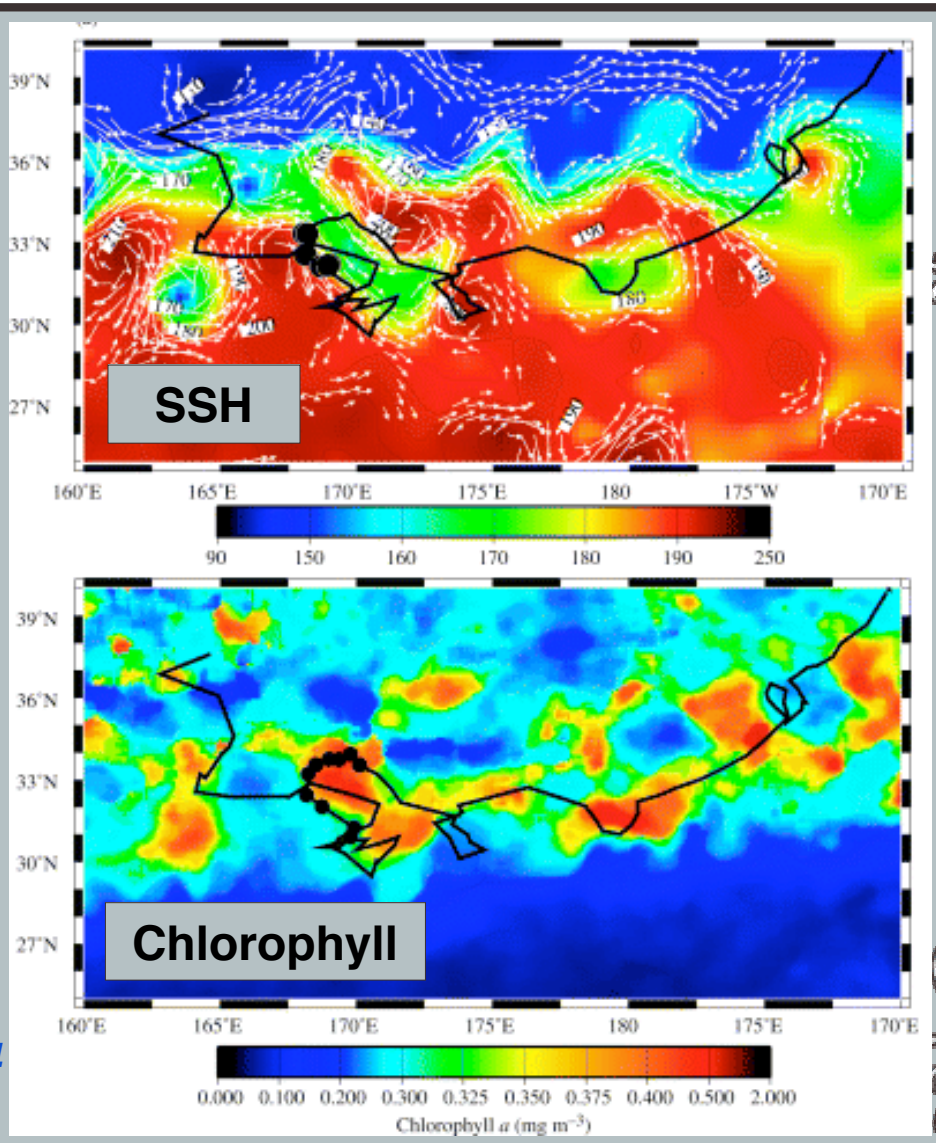
From Platt et al., Nature, 2003

Characterizing Habitat

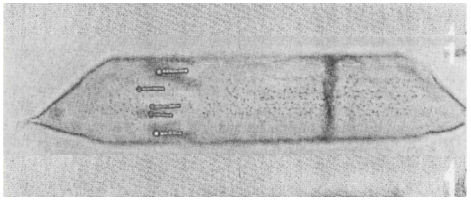
Loggerhead turtle tracks along the Transitional Zone Chlorophyll Front (TZCF) in the N. Pacific during Feb. '01

The TZCF is an important foraging ground for a number of commercial and protected species.

Interannual variability in its location has been tied to the reproductive success of endangered monk seal pups.



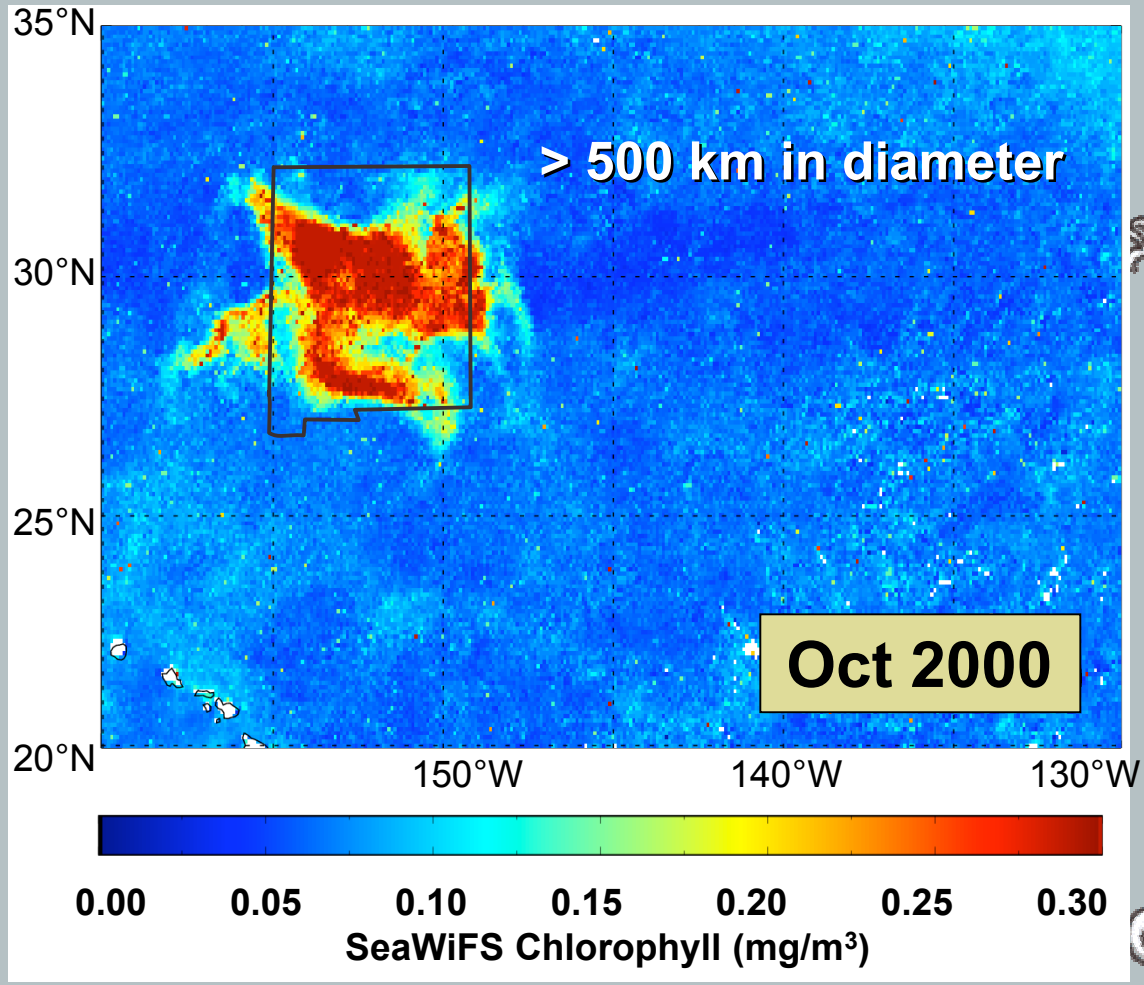
Polovina et al., Fish. Ocean., 2004
NOAA/NMFS/PIFSC



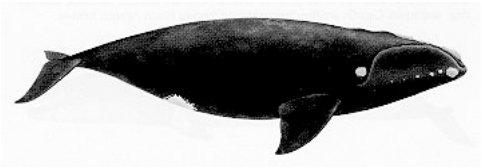
Discovering Habitat?

Large recurrent chlorophyll blooms discovered with satellite data in the middle of the oligotrophic Pacific gyre.

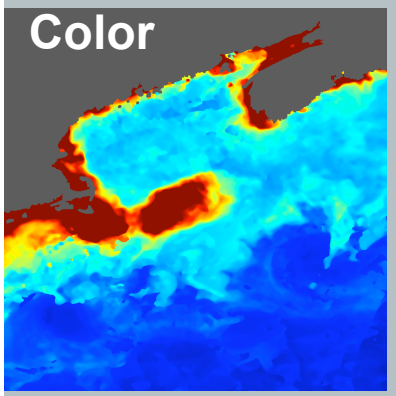
The blooms occur within the target area of several fisheries, including albacore and swordfish, but their impact on higher trophic levels is not known.



Wilson, GRL, 2003 NOAA/NMFS/SWFSC



Right Whale Forecast



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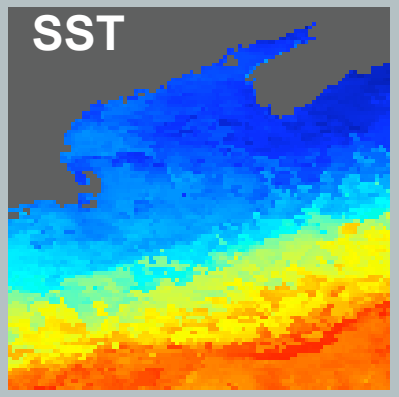

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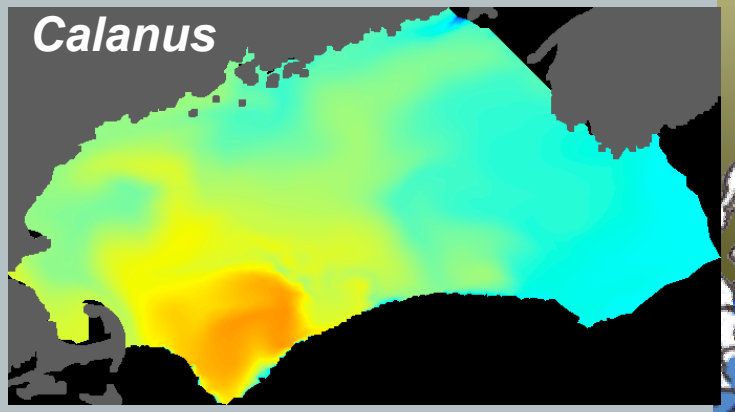

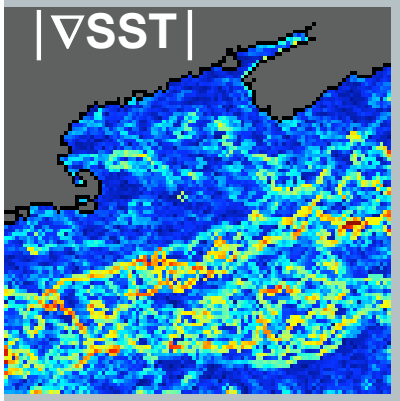

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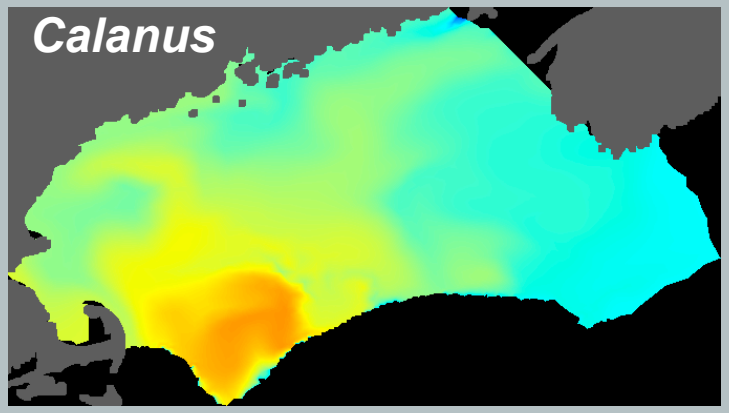

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Whale feeding areas

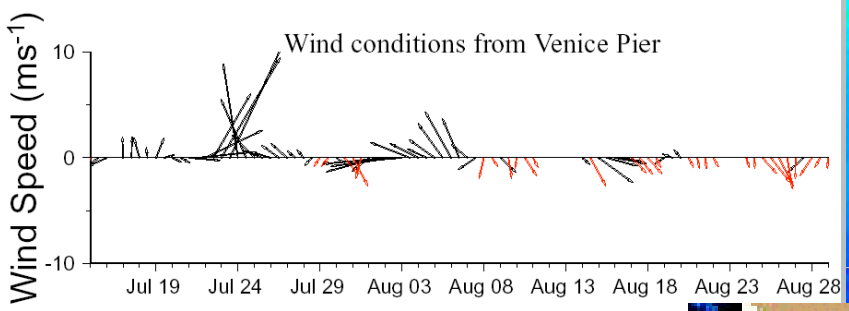
Ship strikes are biggest source of mortality to highly endangered (<400 left) Right Whales. Ability to predict their location will help NOAA minimize ship traffic in those regions.

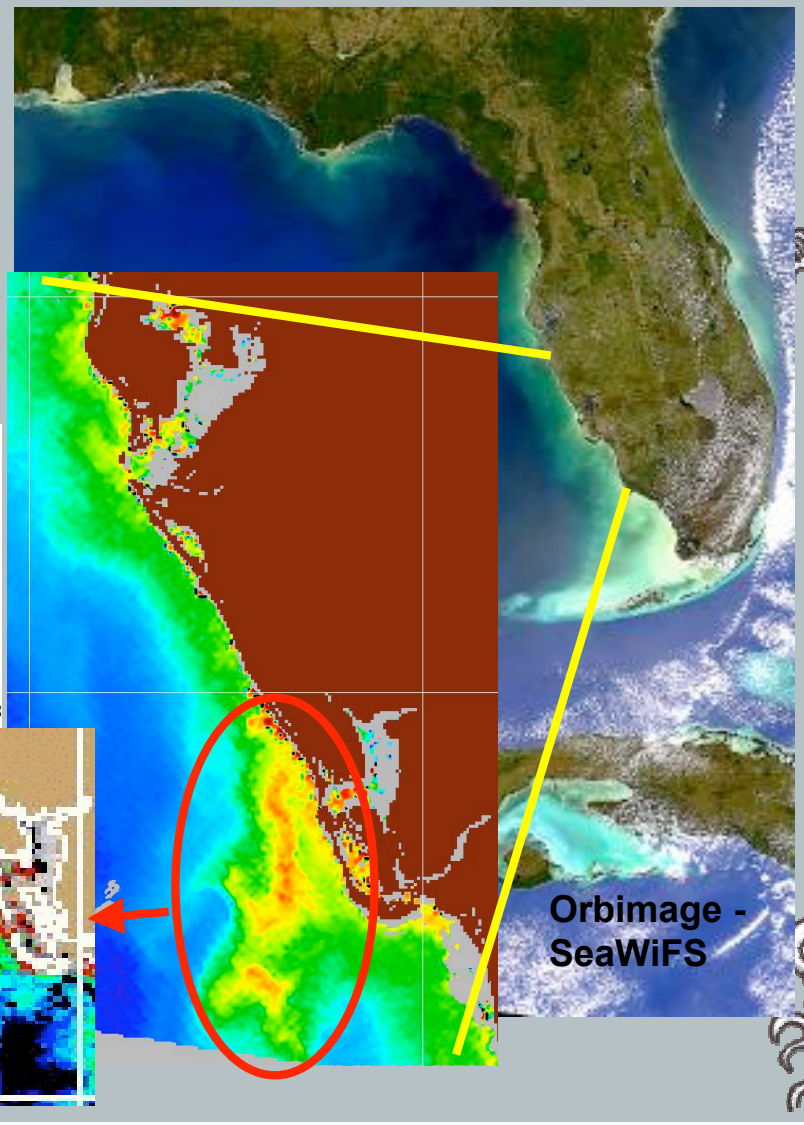
Pershing and Monger, Cornell University, funded by NOAA's Right Whale Grants Program
www.geo.cornell.edu/whales

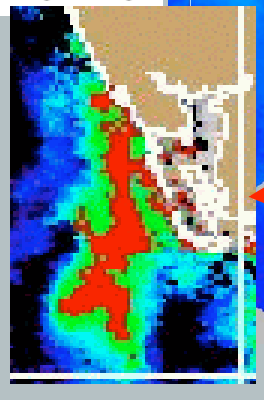
Harmful Algal Bloom (HAB) detection

NOAA National Ocean Service

Operational Monitoring and Forecasting of HABs in the Gulf of Mexico







Courtesy of Rick Stumpf, NOS

Harmful Algal Bloom (HAB) detection

Distributed to Local/State/Federal Government

Page 1

Gulf of Mexico Harmful Algal Bloom Bulletin

21 September 2004

National Ocean Service/NCCOS and CSC

NESDIS/CoastWatch and NDBC

Last bulletin: September 17, 2004

Analysis

HAB Forecast:

No harmful algal blooms have been found along Florida's coast. Recent tropical storms have caused sediment resuspension and non-harmful blooms, which may cause discolored water.

Analysis:

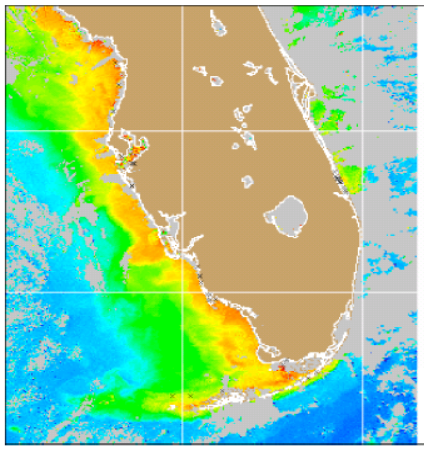
Samples taken last week from southwest Florida near Sarasota, Fort Meyers, and Naples showed no Karenia brevis. Imagery shows elevated chlorophyll along much of Florida's west coast: concentrations over 4 micrograms per liter off Cape San Blas and Cedar Key; over 5 micrograms per liter near Clearwater, Sarasota, Naples; and over 7 micrograms per liter Everglades City.

Winds have favored upwelling in southwest Florida for several days and are forecasted to continue for the rest of the week and through the weekend. These conditions are conducive to HAB formation, so this area should be monitored. Sampling here is recommended. Conditions in the panhandle don't favor HAB formation.

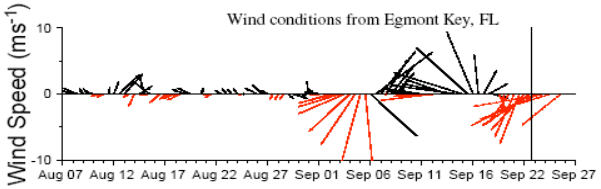
Bronder, Stolz

Please note the following restrictions on all SeaWiFS imagery derived from CoastWatch.

1. These data are restricted to civil marine applications only; i.e. federal, state, and local government use/distribution is permitted .
2. Distribution for military, or commercial purposes is NOT permitted.
3. There are restrictions on Internet/Web/public posting of these data.
4. Image products may be published in newspapers. Any other publishing arrangements must receive OrbImage approval via the CoastWatch Program.



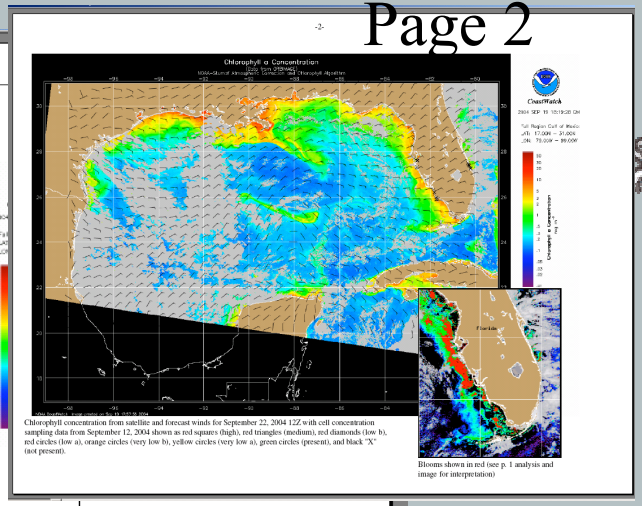
Chlorophyll concentration from satellite with possible HAB areas shown by red polygon(s). Cell concentration sampling data from September 12, 2004 shown as red squares (high), red triangles (medium), red diamonds (low b), red circles (low a), orange circles (very low b), yellow circles (very low a), green circles (present), and black "X" (not present).



Wind speed and direction are averaged over 12 hours from measurements made on buoys. Length of line indicates speed; angle indicates direction. Red indicates that the wind direction favors upwelling near the coast. Values to the left of the dotted vertical line are measured values; values to the right are forecasts.

Southwest Florida: Winds have been northeasterly for the past few days, and are forecasted to shift to easterly then northeasterly over the next couple of days. The NWS Marine Forecast calls for easterly winds until Thursday, then northeasterly winds over the weekend. Florida Panhandle: Winds have been northeasterly for the past few days and are forecasted to become easterly for the next couple of days.

Page 2

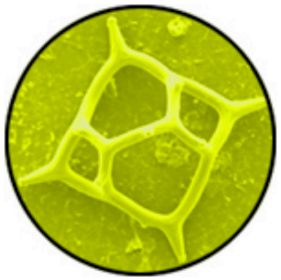


Chlorophyll concentration from satellite and forecast winds for September 22, 2004 12Z with cell concentration sampling data from September 12, 2004 shown as red squares (high), red triangles (medium), red diamonds (low b), red circles (low a), orange circles (very low b), yellow circles (very low a), green circles (present), and black "X" (not present).

Blooms shown in red (see p. 1 analysis and image for interpretation)

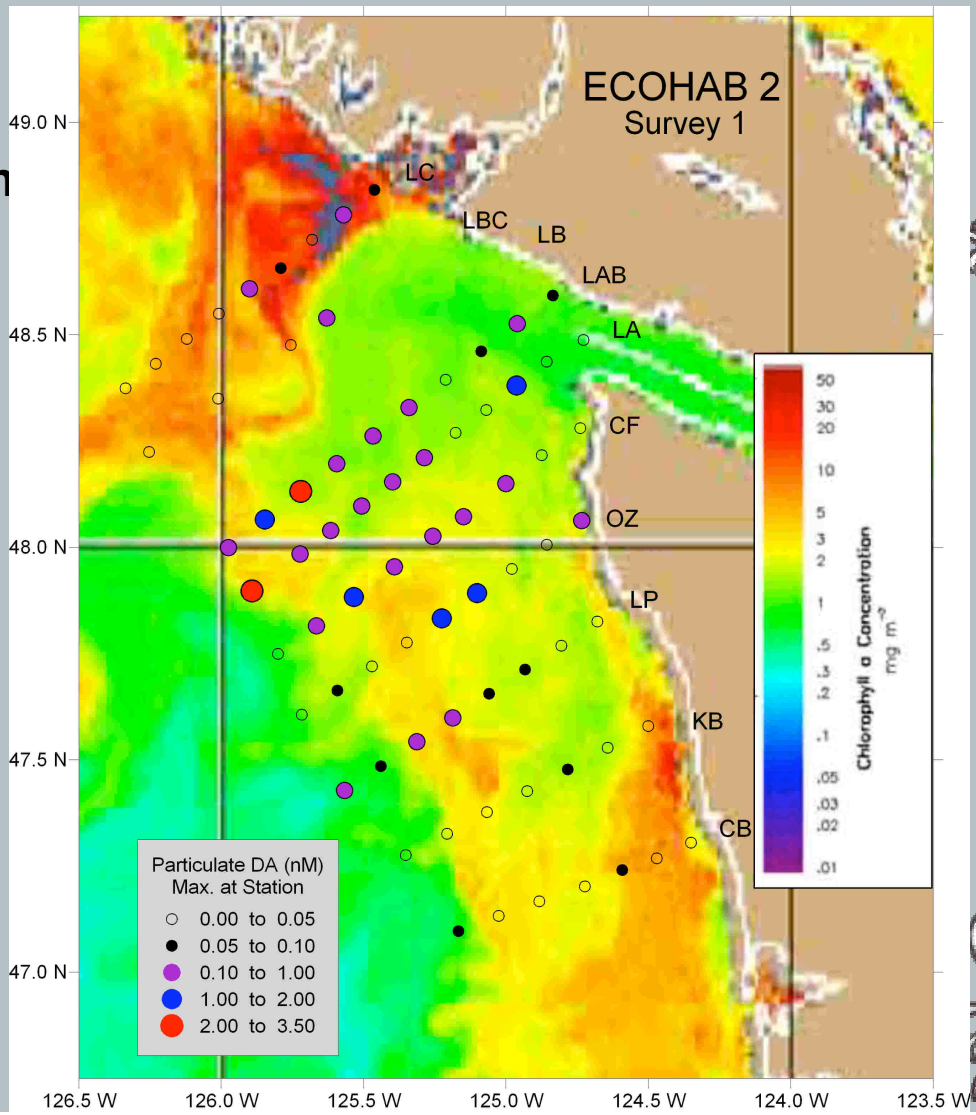
Courtesy of Rick Stumpf, NOS

Cruise Support



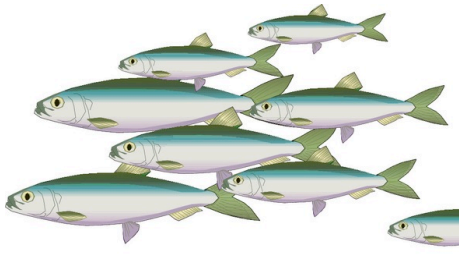
Domoic Acid levels (circles) measured during an ECOHAB survey, overlaid on top of satellite chlorophyll.

Satellite chlorophyll data is crucial for monitoring development of harmful algal blooms (HABs).



From Vera Trainer
NOAA/NMFS/NWFSC


User Needs



Impacts & Benefits of HES-CW data to NMFS

"The increased spatial and temporal resolution of data from the HES-CW on GOES-R will greatly improve our ability to characterize and monitor coastal regions for better management of ecosystems and fisheries."

"Environmental satellite data is essential to efficiently fulfill NMFS's legislated mandates (i.e., the Magnuson-Stevens Act, the Marine Mammal Protection Act, and the Endangered Species Act) to monitor and manage living marine resources and their habitat"

"The US commercial fishing industry contributes ~ $32 billion to the US gross national product, and recreational fishing contributes an additional $25 billion."

- excerpts from 4/20/06 memo from Bill Hogarth (NMFS AA) to Greg Withee (NESDIS AA) about the benefits of GOES-R HES-CW data to fisheries.

Better Resolution with GOES-R…

A direct quote responding to the question of what benefits might be expected from the resolution of data from the GOES-R HES-CW:

"Better resolution increases storage constraints, so while better resolution would be useful for select areas where intensive high research is underway, *a global high res dataset would require a great deal more resources to manage… and I am not sure how useful this would be to marine researchers.*"

Meaning ?!?!…..

Better Resolution with GOES-R…

Meaning –

We are currently doing an inadequate job of supplying user-friendly means of:

- **ACCESS,**
- **MANIPULATION, and**
- **DELIVERY of satellite data**

This must be improved before the launch of GOES-R!

Data Access Issues

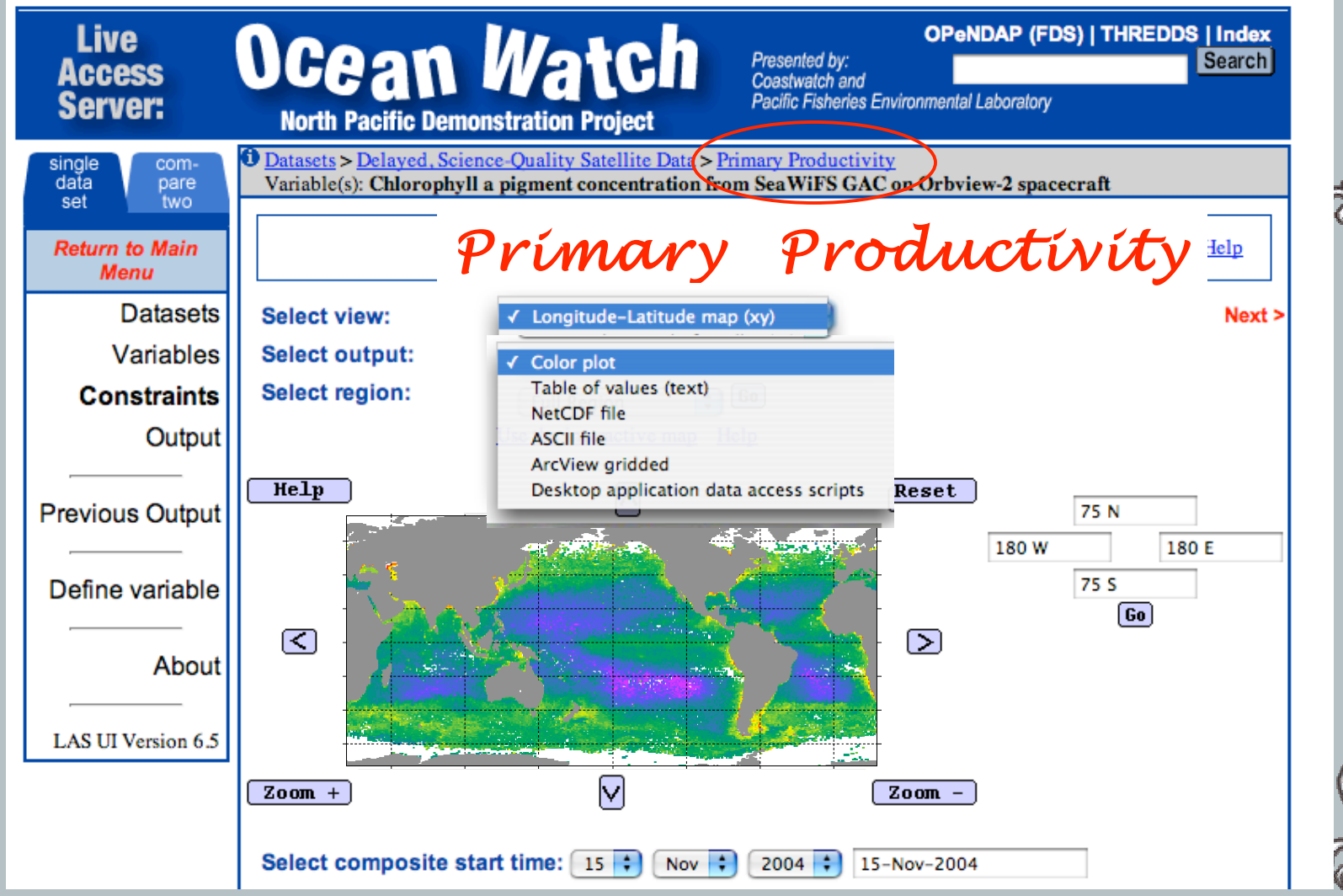
It can be difficult to access and manipulate the large depository of existing satellite data. Efforts are underway to address this:

- **New live access server (LAS) and browser at the west coast CoastWatch Node provide access to multiple satellite datasets, in a variety of formats, including IOOS-compatible OPeNDAP technology.**
- **4 NMFS scholarships given this year to attend a 2-week satellite course at Cornell University**
- **A 3-day course for NMFS and NOS participants on accessing and using satellite data is being planned for Aug. 22-24 at OSU in Corvallis, OR.**

These activities made possible by funding by NOAA's R&O project

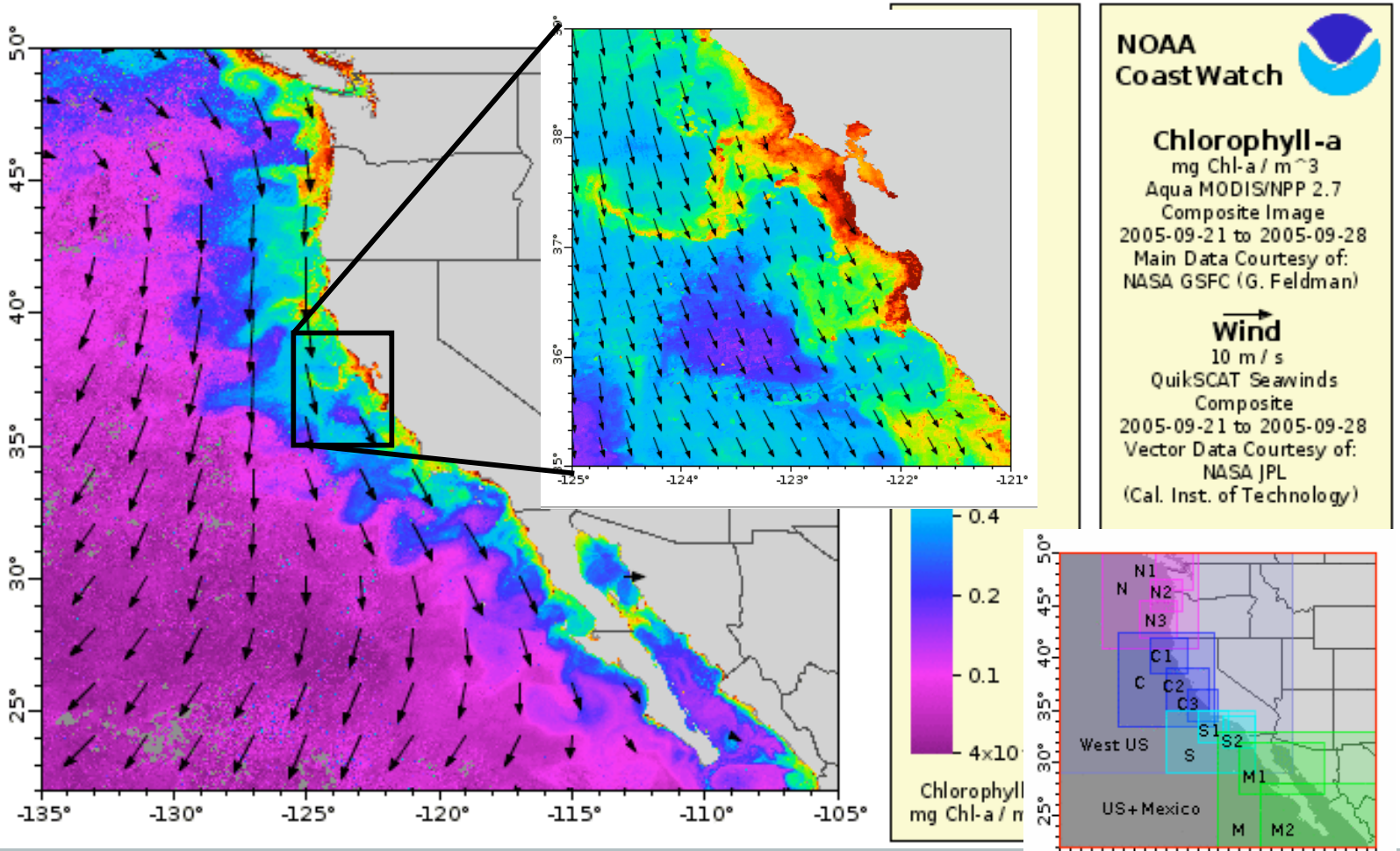
SWFSC OceanWatch LAS at ERD

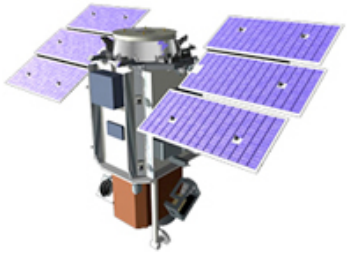
http://oceanwatch.pfeg.noaa.gov



New CoastWatch Browser

http://coastwatch.pfel.noaa.gov/coastwatch/CWBrowser.jsp





Satellite Data Training Course

- 3-day course for NMFS and NOS participants who are interested in using satellite data
- Aug 22-24, 2006 at OSU/CIOSS in Corvallis, OR
- Funds available from NOAA's Satellite Transition R&O (Research and Operations) project to cover participants travel costs

For more information contact Cara Wilson

cara.wilson@noaa.gov

What Resource Managers want

- High Quality datasets
- Temporal and spatial resolutions compatible with management activities and ecosystem dynamics
- Long, consistent, time series
- Flexible, easy access to data (OPenDAP, LAS, CWBrowser etc...)
- Subsetting, and slicing capabilities
- Multiple file formats
- “One-stop shopping” for multiple datasets